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ABSTRACT

The purpose of this study was to modify and validate a new form of the Colleges and Universities Classroom Environment Inventory (CUCEI), and to then use it to compare students' actual and preferred perceptions of their classroom learning environments at the senior and tertiary levels of education. The study also examined the attitudes of 504 students towards their science courses. The reliabilities of the modified CUCEI scales were satisfactory. Sizeable relationships were found between students' perceptions of their learning environment and attitudinal outcomes. When the two levels were compared, students at the tertiary level ad a less favorable perception of the learning environment. However, when attitudes were compared students at the tertiary level preferred a more positive attitude in terms of the satisfaction with courses they were taking and the level of difficulty. There was no difference in their attitude to speed delivery of science courses. (Author)

Classroom Environments and Students' Attitudes to Science at the Senior Secondary and Tertiary Levels

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The purpose of this study was to modify and validate a new form of the Colleges and Universities Classroom Environment Inventory (CUCEI), and to then use it to compare students' actual and preferred perceptions of their classroom learning environments at the senior secondary and tertiary levels of education. The study also examined the attitudes of 504 students towards their science courses. The reliabilities of the modified CUCEI scales were satisfactory. Sizeable relationships were found between students' perceptions of their learning environment and attitudinal outcomes. When the two levels were compared, students at the tertiary level had a less favourable perception of the learning environment. However, when attitudes were compared students at the tertiary level preferred a more positive attitude in terms of the satisfaction with courses they were taking and the level of difficulty. There was no difference in their attitude to the speed of delivery of science courses.

Introduction

Research over the last four decades has recognised that students' and teachers' perceptions are important parameters of the social and psychological aspects of the learning environments of school classrooms (Fraser, 1994, 1998). Considerable work has been done on the assessment and investigation of classroom environments in primary and secondary schools with a variety of instruments (Fraser, 1994, 1998).

Fraser, Treagust, Williamson, and Tobin, (1987) reported that despite the existence of strong traditional classroom environment research at the primary and secondary level, surprisingly little work had been done at the higher education levels because of the shortage of suitable instruments. The College and University Classroom Environment Inventory (CUCEI) was developed in 1986 to fill this void (Fraser, Treagust, & Dennis, 1986). The CUCEI was specifically designed for small class sizes of about 30 students for upper secondary and tertiary levels utilising either seminar or tutorials as the mode of delivery. The seven-scale, 49 item instrument was designed with both a student and instructor version for the actual and preferred classroom environment. The seven scales in the CUCEI are Personalisation, Involvement, Student Cohesiveness, Satisfaction, Task Orientation, Innovation and Individualism. The CUCEI is available in the actual and preferred versions. The actual version measures the participants actual perception of their classroom learning environment whereas the preferred form measures perception of the classroom learning environment preferred by the students in a study.

Walberg's theory on educational productivity indicates nine factors which contribute to the variance in students' cognitive and affective outcomes. The nine factors being student ability, maturity, motivation, the quality of and quantity of instruction, the psychological environment at home, the classroom social group, the peer group outside the classroom and the time involved with the

video/television media (Walberg, 1981, 1984). The model was successfully tested as part of a national study showing that student achievement and attitudes were influenced jointly by these factors (Walberg, Fraser, & Welch, 1986). An interesting outcome from these studies was the finding that classroom and school environments were important influences on student outcomes. These findings lend support to Getzels and Thelen's (1960) theoretical model which describes the class as a social system in which group behaviour can be predicated from the personality needs, role expectations and classroom environment. Studies have also shown that learning environments are accurate predictors of the quality of learning that students receive (Fraser, 1991; Ramsden, 1991; Templeton & Jensen, 1993).

Recent studies now indicate that a personalised measurement, that is the student's personal perception in his or her role in the classroom yields greater feedback from participants in the study whereas the former approach makes the student provide perceptions of the class as a whole (Fraser, Fisher, & McRobbie, 1996).

Method

This study primarily focuses on the development and validation of a modified form of the CUCEI and investigates the students' and instructors' perceptions of the classroom environment at the tertiary and upper secondary levels. In addition, the study also looks into student attitudes towards their courses at these levels.

The Sample

A total of 504 students participated in the study which covered a variety of science subjects. 205 participants were from Canadian institutions and the remaining, 299 students Australian institutions. Twenty four instructors took part in this study. Both students and teachers completed both forms of the instrument, the preferred and actual. Only students filled in the attitudinal questionnaire.

Modified CUCEI

Student and instructor perception of their classroom learning environment were measured using the seven scale, 49-item modified and personalised College and University Classroom Environment Inventory (CUCEI). The CUCEI in this study was modified in three ways. First, the actual and preferred versions of the questionnaire were personalised and secondly, only five of the seven original scales were used and two new scales included; the Cooperation and Equity scales (Fraser, Fisher & McRobbie, 1996). Finally, the existing four response alternatives were replaced with a five-point Likert Scale. The number of scales was maintained at seven with each scale having seven items. Table 1, below shows the seven scales in the final version of the modified CUCEI along with sample items.

Student Attitudes

Student attitudes were measured using three specific scales, Table 2. The three scales which were chosen were the Difficulty, Speed and Satisfaction scales. Each scale has seven items and each item responding to a four response alternatives. Data were analysed using the individual and class as the basis to investigate the relaibilities of the seven modified scales. Correlation and regression analyses on all data on a student-by student basis were performed to investigate various associations and student attitudes.

Qualitative Data

Volunteers were sought in the qualitative component of this study to take part in an interview regarding their perceptions of the classroom environment. Three students were picked from the volunteers and interviewed. Three instructors at the tertiary level from the different science disciplines were also interviewed. In addition to the interviews, the researcher was involved in classroom observation at the tertiary level.

Table 1 Descriptive Information for the Modified CUCEI

Scale Name	Description	Sample Items
Personalisation his/her	Extent on opportunities for individual students to interact with the instructor and on concern for students personal welfare.	The instructor goes out of his/her way to help me.
Innovation	Extent to which the instructor plans new, unusual activities, teaching techniques and assignments.	The instructor often thinks of unusual activities.
Student Cohesiveness	Extent to which students know, help and are friendly towards each other.	I make friends easily in this class.
Task Orientation	Extent to which class activities are clear and well organised.	Class assignments are clear and I know what I am doing.
Individualisation Activities	Extent to which students are allowed to make decisions and are treated differently according to ability, interests and rate of working.	I am allowed to choose activities and how I will work
Cooperation	Extent to which students cooperate rather than compete with one another on learning tasks.	I work with other students in this class.
Equity	Extent to which students are treated equally by the teacher	I am treated the same as other students in this class.

Table 2 Descriptive Information of Scales Used to Measure Attitude

Scale Name	Description	Sample Items
Satisfaction	Extent of enjoyment of classes.	I look forward to coming to this class.
Difficulty	Extent to which students find difficulty with the work in the class.	I find the work in this class difficult.
Speed	Extent to which class work is covered quickly.	The pace in this class is rushed.

Reliability and Validity of the Instruments

Internal Consistency

The Cronbach alpha reliability using two units of analyses for each of the seven scales in the CUCEI, for the actual and preferred versions are presented in Table 3. The Cronbach alpha reliability figures using the individual student as the unit of analysis ranged from 0.73 to 0.93 and 0.76 to 0.94 for the actual and preferred versions respectively. With class means as the unit of analysis, all alpha reliability values were higher, ranging from 0.84 to 0.97 for the actual version and 0.87 to 0.98 for the preferred. Good alpha reliability figures was also apparent for instructor versions, ranging from 0.72 to 0.90 for the actual version and from 0.72 to 0.93 for the preferred version.

Discriminant Validity

The discriminant validity is described as the extent to which a scale measures an unique dimension not covered by the other scales in the instrument. Table 3 also indicates that the mean correlations of the scales in the CUCEI ranged from 0.15 to 0.38 for the actual version and from 0.25 to 0.47 for the preferred form. From the values, the CUCEI appears to measure distinct although somewhat overlapping aspects of classroom environment, but maintaining distinctions between each scale in each of the seven dimensions in the instrument.

Table 3 Internal Consistency Reliability (Cronbach Alpha Coefficient) and Discriminant Validity (Mean Correlation with Other Scales) and the Ability to Differentiate between Classrooms (ANOVA) for Two Units of Analysis of the CUCEI

CUCEI Scales	Unit of Analysis	Reliability		Mean Correlation with other scales		ANOVA
		Actual	Preferred	Actual	Preferred	eta²
Personalisation	Individual	0.87	0.84	0.34	0.45	0.23**
	Class	0.95	0.87	0.30	0.30	
Student Cohesiveness	Individual	0.82	0.83	0.20	0.47	0.28**
	Class	0.96	0.88	0.38	0.43	
Task Orientation	Individual	0.77	0.79	0.27	0.44	0.27**
	Class	0.92	0.92	0.33	0.44	
Cooperation	Individual	0.92	0.93	0.25	0.45	0.11**
	Class	0.96	0.94	0.29	0.38	
Individualisation	Individual	0.82	0.80	0.15	0.25	0.22**
	Class	0.93	0.94	0.34	0.35	
Equity	Individual	0.93	0.94	0.30	0.42	0.09*
	Class	0.97	0.98	0.38	0.45	
Innovation	Individual	0.73	0.76	0.22	0.43	0.13**
	Class	0.84	0.93	0.35	0.39	

The sample consisted of 504 students in 26 classes

Capability of differentiating between classrooms

The characteristics of differentiating between perceptions in different classes was investigated for each scale using a one-way ANOVA with class membership as the main effect and using the individual as the unit of analysis. Table 3 above indicates that each CUCEI scale differentiated significantly ($p<0.001$) between classrooms.

Learning Environments and Attitude

Student and instructor differences were explored using a paired t-test analysis for each scale of the CUCEI and the attitude measurement. Table 4 provides scale means for all seven scales of the CUCEI for both levels, and indicate the magnitude of the difference between scale means. The data indicate that students at both levels perceive their environments differently.

Table 4 Means and Differences for the Preferred and Actual Forms of the CUCEI for Students in their Senior Secondary and Tertiary level of Study

Scales	Preferred		Difference	Actual		Difference
	Tertiary (T)	Senior (S)	(T-S)	Tertiary (T)	Senior (S)	(T-S)
Personalisation	4.19	4.20	-0.01	3.56	3.98	-0.42**
Student Cohesiveness	3.82	3.92	-0.10	3.37	3.98	-0.61**
Task Orientation	4.29	3.79	+0.50**	3.95	3.77	+0.18**
Cooperation	3.93	3.72	+0.21	3.40	3.81	-0.41**
Individualisation	3.03	3.42	+0.39**	2.11	2.50	+0.39**
Equity	4.61	4.03	+0.58**	4.41	4.31	+0.10
Innovation	3.48	3.51	-0.03	3.29	2.98	+0.31**

**p<0.05 n = 130

Figure 1 below shows the profile of the data in Table 4.

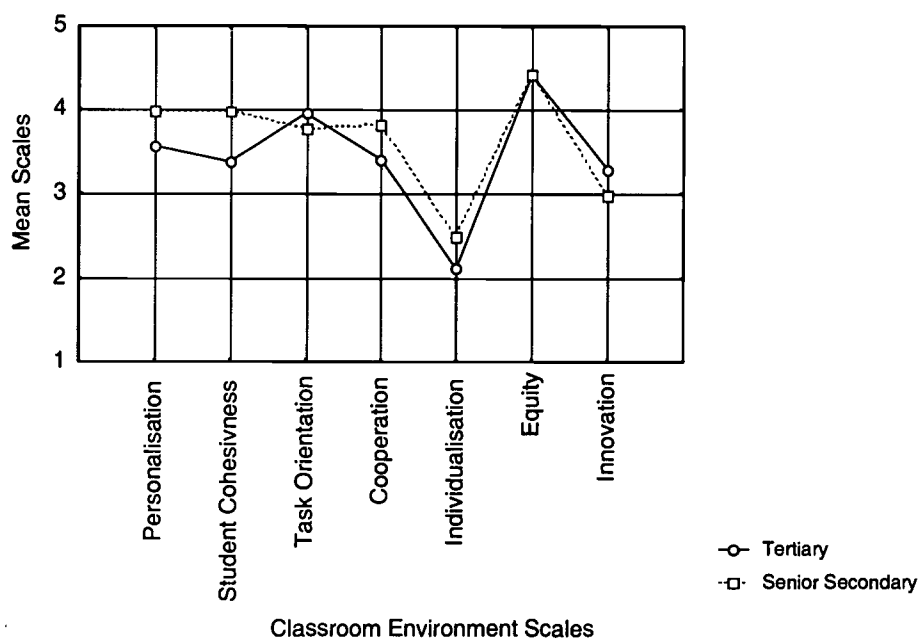

Figure 1.Comparison of Actual classroom environment scales for students at the tertiary and senior secondary level of studies

Students at the senior secondary level generally perceived their environment more favourably before transition to the higher level of studies. Of the six statistically significant scales in the actual version, only Innovation and Task Orientation scales were perceived favourably by students at the higher level of education. Students at the tertiary level gauged their classroom more favourable in the innovative teaching methods employed in the classroom. This seems to be supported by the comments of the instructors. For example, the Biology instructor enunciated;

> I have never used a formal lecture system. I use a fair amount of handouts, so if you take the standard set of materials, I will give them a handout with the bottom line in terms of vocabulary and concept that they have to know. Depending on the course level, I will also put my lecture notes on reserve. They have this as a fall back. I find straight lecturing - the retention rates with students is not great, they have to get involved with the material, whether you have to make it outrageous at times or whether to peak their interest. I try to teach them more about concepts and get them thinking, not to memorise but understand it. I will actually adjust the sequence of what I am doing and how I am doing it based on the profile of the class. I have certain standards I have to work to and I will achieve this either in a couple of months or in two semesters. I will get to that either sooner or later depending on the class. The results (from the use of this technique) not only come out in the examinations and tests but I have students coming back from subsequent years attending other institutions and they have done quite well.

Students at the tertiary level also perceived less student cohesiveness. Though this finding is similar to previous research (Midgley, 1991), this is at odds to what was expected as enunciated by classroom instructors;

> Student Cohesiveness in the class is high because most students know each other before commencing at the college because they come from the region, the local high schools. They know each other. Most come from the same high school. Everyone is friendly in class. I can't take credit for this.

Students also experienced less favourable interpersonal relationships with the instructors after transition. This is seen in the lower mean values in the Personalisation scale at the higher level of study, 3.98 compared with 3.56. Further supporting this less favourable interpersonal experience is the comment from a tertiary student:

> I found the caring aspect in high school where the teachers' job was to make you learn (was missing) as opposed to just delivery of the lesson at the college. I find it different.

Both levels reported unfavourably in the Individualisation scale, with students at the tertiary level perceiving the class more unfavourably. This suggest that students perceive that there is less choice at the higher level of studies. Similar findings were also reported by researchers in their study of transition environments from the elementary to junior high school (Midgley, Eccles, & Feldlaufer, 1991). This dissatisfaction is clearly demonstrated by the expressed views;

> To be frank it is overwhelming (workloads). I was swamped when I first got here. I did not believe how much work they (instructors) expected. In high school they don't have this stuff. I spend 18 hours on a report. It is unreal.

Further, this unfavourable perception could also be possibly due to students relying on their instructors for what they should know before they move on to their next year of university work, and as such do not want too much decision making authority at this level. This reasoning seems to be supported by the comments of the Biology and Physics instructors.

We have no control. We have to cover X amount of material before they move on to their second year. If they work on their own pace they would have nothing done. It is a university lecture and there is a certain amount of material to cover and you cover it.

Attitudinal Outcomes

Both levels showed significant differences in all the attitude scales with the exception of Speed (see Figure 3).

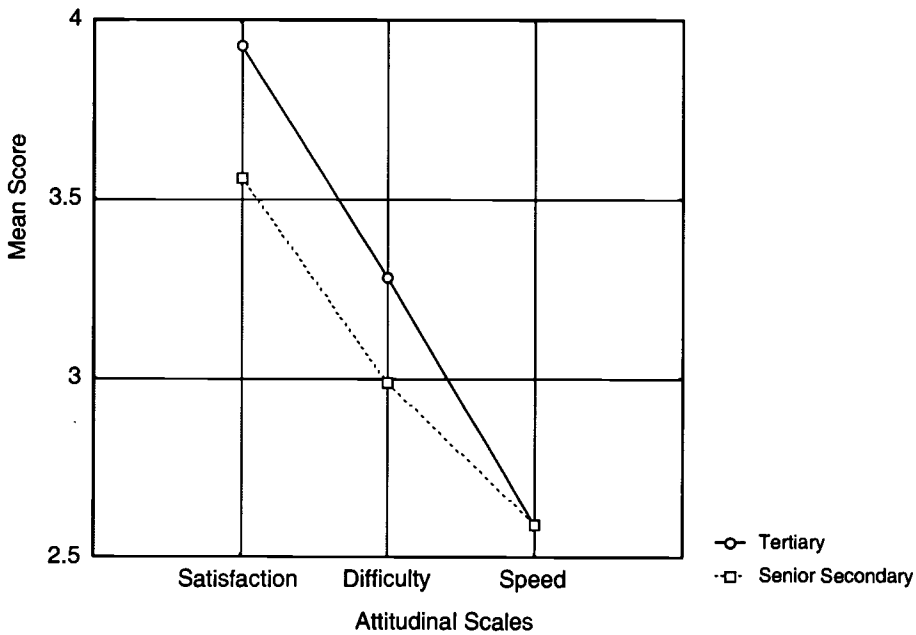

Figure 3. Comparison of Attitudes at the senior secondary and tertiary levels.

The greatest differences at both levels were in the Satisfaction scale, Table 5. Tertiary students perceived their classes as more difficult, faster in pace and overall less satisfying than at the senior secondary level. However, students at the higher level generally did not find that the speed of the courses they were taking needed any alteration. This is echoed in the student interview:

It is pretty fast. It is not a bad thing, it is just fast. I don't have a problem.

Table 5 Comparison of Means for the Attitudinal Measures

Scales	Tertiary (T)	Senior Secondary (S)	Mean Difference (T-S)
Satisfaction	3.93	3.56	0.37 **
Difficulty	3.28	2.99	0.29 **
Speed	2.59	2.66	-0.07

** $p<0.05$ n=130

Associations Between Students' Perceptions of their Learning Environment and Attitudinal Outcomes

Associations between students' perceptions of the learning environment and students' attitudinal outcomes were analysed using both simple correlation (r), which describes the bivariate associations between an attitudinal measure and each CUCEI scale, and the standardised regression weight (ß), which characterises the associations between a measure and a particular environment scale when all other CUCEI scales were controlled. The simple correlation (r) reported in Table 6 indicates that all seven scales were significantly related to the student Satisfaction outcome ($p<0.001$) and two scales, namely, Individualisation and Innovation were significantly related to the attitudinal measure of Speed and only with Individualisation scale with Difficulty. The beta (ß) weights show that all three attitude scales retained their significance with the Individualisation scale in a more conservative multivariate test.

Table 6 Associations Between CUCEI Actual Scales and the Attitudinal Measures in Terms of Simple Correlation (r) and Standardised Regression Coefficients (ß)

CUCEI Scales	Speed		Difficulty		Satisfaction	
	r	ß	r	ß	r	ß
Personalisation	-0.17**	-0.03	-0.03	0.08	0.41**	0.18**
Student Cohesiveness	-0.22	0.02	-0.03	-0.01	0.18**	0.05
Task Orientation	-0.07	-0.03	-0.00	-0.03	0.36**	0.23**
Cooperation	0.00	-0.10*	0.01	0.05	0.21**	0.02
Individualisation	-0.27**	-0.24**	-0.22**	-0.23**	0.21**	0.15**
Equity	-0.66	-0.04	0.03	0.00	0.23**	-0.02
Innovation	-0.20**	0.10*	0.08	0.07	-0.25**	-0.05
Multiple R Correlation	0.37**		0.24**		0.51**	
R^2	0.11		0.06		0.26	

*p<0.05 **p<0.001 n=504

Conclusions

This study confirms the reliability and validity of the modified and personalised CUCEI. This study is distinct in that it is the first study utilising the modified CUCEI simultaneously at the tertiary and secondary levels.

This study shows that students perceived their classroom more negatively when they moved from the lower level of studies to a higher level. As well, tertiary students were more dissatisfied in their attitude towards their science courses. An interesting result was that there was no significant difference in the speed of the courses, students did find the workload overwhelming but see no problems related to this.

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